Corrections and Additions to the Publication, <u>Identification</u>

 $\underline{\text{and}} \ \underline{\text{Geographical}} \ \underline{\text{Distribution}} \ \underline{\text{of}} \ \underline{\text{the}} \ \underline{\text{Mosquitoes}}$

of North America, North of Mexico

Ronald A. Ward and Richard F. Darsie, Jr.²

ABSTRACT. Corrections and additions are provided as a supplement to the publication, <u>Identification and Geographical Distribution of the Mosquitoes of North America</u>, <u>North of Mexico</u>.

INTRODUCTION

Following the publication of Darsie and Ward (1981), certain errors and corrections have been brought to our attention and are appended below in an Errata section. As the chapters, Bibliography of Mosquito Taxonomy and Geographical Distribution, and Addendum to Bibliography in Darsie and Ward (1981) surveyed the relevant literature through most of 1979, we are providing annotated references from 1979 to mid-1982. In addition, several pre-1979 publications are cited that were earlier omitted. Certain species merit comment and are noted along with new distribution records at the state (U.S.A.) and province (Canada) level.

We wish to thank Peter Belton, Alain Maire and Lewis T. Nielsen who have provided data for our use and Bruce Harrison for his advice on an earlier draft.

ERRATA

Page 7, line 19
For Interocular setae (IS), read Interocular setae (ISe)

Page 8, lines 39, 43, 48
For meskatepisternum, read mesokatepisternum

Page 9, line 39 For Fig. 15, read Fig. 38

Ronald A. Ward, Department of Entomology, Walter Reed Army Institute of Research, Washington, D. C. 20012

²Richard F. Darsie, Jr., Division of Parasitic Diseases, Chamblee 23, Center for Infectious Diseases, Centers for Disease Control, Atlanta, Georgia 30333.

maintaining the data needed, and c including suggestions for reducing	lection of information is estimated tompleting and reviewing the collecthis burden, to Washington Headquald be aware that notwithstanding a DMB control number.	tion of information. Send comment parters Services, Directorate for Inf	s regarding this burden estimate formation Operations and Reports	or any other aspect of to s, 1215 Jefferson Davis	his collection of information, Highway, Suite 1204, Arlington	
1. REPORT DATE 1982		2. REPORT TYPE		3. DATES COVE 00-00-198 2	ERED 2 to 00-00-1982	
4. TITLE AND SUBTITLE					5a. CONTRACT NUMBER	
Corrections and Additions to the Publication, Identification and Geographical Distribution of the Mosquitoes of North America, North of Mexico					5b. GRANT NUMBER	
					5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)			5d. PROJECT NUMBER			
					5e. TASK NUMBER	
					5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Walter Reed Army Institute of Research, Department of Entomology, Washington, DC, 20012					8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)		
					11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAIL Approved for publ		ion unlimited				
13. SUPPLEMENTARY NO	TES					
14. ABSTRACT see report						
15. SUBJECT TERMS						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	Same as Report (SAR)	11		

Report Documentation Page

Form Approved OMB No. 0704-0188

Page 202, Fig. 895

For inornator, read inornata

```
Page 9, line 41
     For Fig. 221, read Fig. 222
Page 10, line 49
     For the, read The
Page 14, In list of abbreviations for Plate 4, add PMe-pleural membrane
Page 27, Couplet 1, lines 1 and 2
     For hindtarsomere, read hindtarsomeres
Page 30, Figs. 59, 61
     For Hindtarus, read Hindtarsus
Page 44, Fig. 140
     For candensis, read canadensis
Page 51, line 2
     For posterior, read anterior
Page 115, line 44
     For Fig. 789, read Fig. 815
Page 115, line 45
     For Fig. 815, read Fig. 784
Page 116, line 25
     For Figs. 514, 516, read Figs. 514, 516, 855
Page 119, 1ine 7
     For mesurement, read measurement
Page 132, Couplet 11
     Should read:
       11 (10).
                 Saddle completely encircling segment X (Fig. 538),
                 or if not, siphon aciculate (Fig. 824) . . . . . . . . .
                 Saddle not completely encircling segment X (Fig. 539);
                 siphon not aciculate . . . . . . . . . . . (in part) Aedes
Page 133, Couplet 14, lines 2 and 3
     For tergum on VII, read segment VII
Page 182, Figs. 790, 792
     For 1-I-IV, read 1-IV
Page 199, Figs. 878, 880
     For Ventral view, read Dorsal view
```

- Page 214, Couplet 8
 For johnstonni, read johnstonii
- Page 215, Fig. 958
 For abdomen Ps., read abdomen Ps.
- Page 220, Fig. 983 For thorax Wy, read thorax - Wy.
- Pages 226 and 233, column 1
 Heading should read Mosquito Species
- Page 241, line 8 For MAN (470), read MAN (70, as Ae. triseriatus)
- Page 258, line 5 For NE (164), read NE (373)
- Page 260, Plate 35, line 2 For NM 3/8K_!(, read (502)
- Page 260, Plate 35, line 3 For MQ, read MO
- Page 287, ref. 311
 For silvertris, read silvestris
- Page 290, ref. 398 For Schyler, read Schuyler
- Page 297, line 12 For 57, 60, read 57-60
- Page 305, Fig. 670 For Pina, read Pima
- Page 312, line 46
 For mulrennai, read mulrennani
- Page 313, line 4
 For s. spenceri, read s. spencerii

COMMENTS ON CERTAIN SPECIES

Aedes (Aedes) hemiteleus Dyar. Bickley (1980) studied the adult morphological characters of the North American members of the Cinereus Group (sensu Peus 1972) and found them too variable to discriminate Ae. hemiteleus from Ae. cinereus Meigen, or other members of the group. However, in the absence of adequate North American specimens with associated immature skins, we feel it is not advisable to synonymize Ae. hemiteleus with Ae. cinereus.

Aedes (Finlaya) togoi (Theobald). Belton (1980) presented conclusive evidence that Ae. togoi is now established south of Anacortes, Washington, in rock pools along the coastline. He indicated that Ae. togoi is probably a recent introduction from Asia (within the past 40 years) and may have been dispersed through the agency of ferry traffic among islands. Since this species is already included in Darsie and Ward (1981), no modifications to the keys are required.

Culex (Melanoconion) taeniopus Dyar and Knab. The new synonomy of Cx. (Mel.) opisthopus Komp with taeniopus by Sirivanakarn and Belkin (1980) will undoubtedly cause consternation among some North American mosquito workers. Through the proper examination of type-specimens and the application of the principle of priority, Sirivanakarn and Belkin (l.c.) have resolved a difficult problem of nomenclature.

Culex (Tinolestes) latisquama (Coquillett). The presence of this species in the U. S. is based on one male supposedly collected in 1906 from Estero, Lee county, Florida (Stone 1968). Since additional specimens have not been collected north of Honduras, Berlin and Belkin (1980) believed the Florida record is erroneous. They attribute this to an incorrect label on specimens collected for the "Mosquitoes of North and Central America and the West Indies" (Howard, Dyar and Knab 1915). As we do not wish to perpetuate the error, Cx. latisquama is removed from the list for the subject area. This reduces the list of species and subspecies known to occur in North America, north of Mexico, from 167 to 166.

Culiseta (Culiseta) annulata (Schrank). Faran and Bailey (1980) collected a single adult female Cs. annulata at Fort McHenry, Baltimore, Maryland, from the inner walls of an old munitions bunker. This female was collected in association with overwintering Cx. pipiens Linn. females and survived 20 days in the laboratory. Due to the proximity of Fort McHenry to Baltimore harbor, it is probable that this specimen or its ancestors were introduced into the area by a ship travelling from Europe. Since further specimens have not been reported, Cs. annulata is not yet an established faunal component.

Wyeomyia (Wyeomyia) smithii (Coquillett) and Wy. (Wyo.) haynei Dodge. Bradshaw and Lounibos (1977) examined the effects of latitude, altitude and longitude on photoperiodicity, morphology of larval anal papillae, stage of dormancy and response of F1 hybrids of pitcher-plant mosquitoes of the genus Wyeomyia from eastern North America. They conclude that Wy. smithii is probably a polytypic species which includes Wy. haynei as a geographic subspecies. Their observation that Wy. haynei populations from the Gulf Coast possess four long anal papillae is of interest and indicates the need for a rigorous taxonomic analysis of extensive series of reared specimens of both species throughout the entire range. These should be complemented by a series of cross-breeding experiments from various critical populations. Until these studies have been accomplished, haynei and smithii should be retained as discrete species.

reals "asingle jedystell ejedies."

Musica Mes . Hhat I here is but one species."

1000 M. hagres is agreed to so exercise.

CHANGES TO STATE AND PROVINCE DISTRIBUTION RECORDS

The following new United States and Canada distribution records have come to our attention since Darsie and Ward (1981) was submitted to the printer. Changes in distribution such as county records are included in the Annotated References.

SPECIES	POLITICAL UNIT	REFERENCE
Ae. atropalpus	IN	Restifo and Lanzaro (1980)
Ae. atropalpus	NFLD	Nielsen and Mokry (1982b)
Ae. cinereus	WV	Butler and Amrine (1980)
Ae. decticus	NFLD	Nielsen and Mokry (1982b)
Ae. diataeus	NFLD	Nielsen and Mokry (1982b)
Ae. dorsalis	NH	Burger (1981)
Ae. euedes	WY	Nielsen (1982)
Ae. grossbecki	MI	Cassani and Newson (1980)
Ae. hendersoni	FL	Zavortink and Belkin (1979)
Ae. hexodontus	NFLD	Nielsen and Mokry (1982b)
Ae. nevadensis	ВС	Belton and Belton (1981)
Ae. pionips	NFLD	Nielsen and Mokry (1982b)
Ae. sollicitans	WV	Butler and Amrine (1980)
Ae. sticticus	NFLD	Nielsen and Mokry (1982b)
Ae. togoi	WA	Belton (1980)
Cs. alaskaensis	UT	Bickley (1979)
Cs. melanura	NFLD	Nielsen and Mokry (1982a)
Or. alba	WV	Heaps (1980)
Ps. cyanescens	IA	Ritchie and Rowley (1980)
Ps. mathesoni	MI	Cassani and Newson (1980)
Ur. sapphirina	CO	Maloney (1980)

Four species were deleted from the list of Nebraska species by Lunt and Rapp (1981) as they were unable to verify their presence within the state on the basis of valid collection records. These include: Aedes fitchii (Felt and Young), Ae. implicatus Vockeroth, Culex quinquefasciatus Say and Culiseta melanura (Coquillett).

ANNOTATED REFERENCES

- Adkins, D. A. 1979. A survey of mosquitoes in Cabell County, West Virginia. Mosq. News 39:267-270. (Eight new county records.)
- Belton, P. 1980. The first record of *Aedes togoi* (Theo.) in the United States aborginal or ferry passenger? Mosq. News 40:624-626. (New Washington State record.)
- Belton, P. and E. M. Belton. 1981. A revised list of the mosquitoes of British Columbia. J. Entomol. Soc. B. C. 78:55-64. (New country record for Ae. nevadensis and additional locality records for numerous species.)
- Berlin, O. G. W. and J. N. Belkin. 1980. Mosquito studies (Diptera, Culicidae) XXXVI. Subgenera *Aedinus*, *Tinolestes* and *Anoedioporpa* of *Culex*. Contrib. Am. Entomol. Soc. (Ann Arbor) 17(2):1-104.
- Bickley, W. E. 1979. Notes on the geographical distribution of three species of *Culiseta*. Mosq. News 39:392. [All records except *Cs. alaskaensis* UT included in Darsie and Ward (1981).]
- _____. 1980. Notes on the status of *Aedes cinereus hemiteleus* Dyar. Mosq. Syst. 12:367-370.
- . 1981 (1982). Notes on the geographical distribution of Aedes canadensis mathesoni. Mosq. Syst. 13:150-152.
- Bourassa, J. P. 1981. Position taxonomique du dipterè *Aedes atropalpus* (Coquillett). Naturaliste Can. 108:185-190.
- Bradshaw, W. E. and L. P. Lounibos. 1977. Evolution of dormancy and its photoperiodic control in pitcher-plant mosquitoes. Evolution 31:546-567.
- Breeland, S. G. 1980. A bibliography to the literature of *Anopheles albimanus* (Diptera: Culicidae). Mosq. Syst. 12:50-150.
- . 1982. Bibliography and notes on Florida mosquitoes with limited distribution in the United States. Mosq. Syst. 14:53-72. (New county records for *De. cancer*.)
- Brogdon, W. G. 1981 (1982). Use of the siphonal index to separate *Culex pipiens* subspecies and hybrids. Mosq. Syst. 13:129-137.

- Brust, R. A. 1979. Occurrence of *Aedes hendersoni* in Manitoba. Mosq. News 39: 395-396. (Not a new provincial record.)
- Burger, J. F. 1981. New records of mosquitoes (Diptera: Culicidae) from New Hampshire. Entomol. News 92:49-50. (New state record of Ae. dorsalis.)
- Butler, L. and J. W. Amrine. 1980. New state and county records for mosquitoes in West Virginia. Mosq. News 40:347-350. (New state records for Ae. cinereus and Ae. sollicitans.)
- Candeletti, T. and F. H. Lesser. 1978 (1980). *Culex tarsalis* in New Jersey. Proc. N. J. Mosq. Control Assoc. 65:95-98.
- Cassani, J. R. and H. D. Newson. 1980. An annotated list of mosquitoes reported from Michigan. Mosq. News 40:356-367. [Includes new state records for Ae. grossbecki and Ps. Mathesoni (as varipes); repeats several older species records that require verification.]
- Covell, C. F., Jr. and A. J. Brownell. 1979. *Aedes atropalpus* in abandoned tires in Jefferson county, Kentucky. Mosq. News 39:142. (New county records.)
- Crans, W. J., F. Lesser and T. Candeletti. 1979. Recent distribution records of Culex tarsalis in New Jersey. Mosq. News 39:244-247.
- Darsie, R. F., Jr. and R. A. Ward. 1981. Identification and geographical distribution of the mosquitoes of North America, north of Mexico. Mosq. Syst. Suppl. 1:1-313.
- Dickson, S. L. 1980. The mosquitoes of southwest Missouri. Proc. Utah Mosq. Abat. Assoc. 32:40-42.
- Faran, M. E. 1980. Mosquito studies (Diptera, Culicidae) XXXIV. A revision of the Albimanus Section of the subgenus *Nyssorhynchus* of *Anopheles*. Contrib. Am. Entomol. Inst. (Ann Arbor) 15(7):1-215.
- Faran, M. E. and C. L. Bailey. 1980. Discovery of an overwintering adult female of *Culiseta annulata* in Baltimore. Mosq. News 40:284-287.
- Gordon, S. W. and E. D. Peterson. 1980. Occurrence of *Toxorhynchites rutilis* septentrionalis in tires in Ohio. Mosq. News 40:107-109. (New county records.)
- Goyette, D. and A. Maire. 1980. Les sentiers de caribous dans l'hemiarctiques, un type seculaire de biotope a larves de moustiques (Culicidae). Can. Entomol. 112:1007-1012.
- Harbach, R. E. and K. L. Knight. 1981 (1982). Corrections and additions to Taxonomists' glossary of mosquito anatomy. Mosq. Syst. 13:201-217.

- Harrison, R. J., R. Loiselle and D. J. Leprince. 1980. Inventaire des moustiques (Diptera: Culicidae) du sud du Québec, 1973-1978. Ann. Soc. Entomol. Quebec 25:195-206.
- du Québec. Ann. Soc. Entomol. Quebec 26:3-8. (List of 51 species.)
- Heaps, J. W. 1980. Occurrence of Orthopodomyia in West Virginia. Mosq. News 40:452. (New record for Or. alba.)
- Howard, L. O., H. G. Dyar and F. Knab. 1915. The mosquitoes of North and Central America and the West Indies. Systematic description, part I. Carnegie Inst. Wash. Publ. No. 159, Vol. 3, 523 pp.
- Johnson, W. E., Jr. and L. Harrell. 1980. The occurrence of *Aedes trivittatus* in Alabama. Mosq. News 40:296-297. (Previous Alabama record questionable.)
- Keith, R. D. 1979. The occurrence of *Aedes grossbecki* in Texas. Mosq. News 39: 797. [Species previously cited in Darsie and Ward (1981).]
- Kruger, R. M. and R. R. Pinger. 1981. A larval survey of the mosquitoes of Delaware county, Indiana. Mosq. News 41:484-489.
- Lang, J. R., D. D. Pinkovsky and R. J. McKenna. 1981. Mosquito vectors collected at CONUS USAF installations and mosquito-borne disease data. Final report for period 1970-1980. Report SAM-TR-81-36. USAF School of Aerospace Medicine, Brooks AFB, TX, 222 pp.
- Lunt, S. R. and W. F. Rapp, Jr. 1981. An annotated list of the mosquitoes of Nebraska. Mosq. News 41:701-706. (Four species deleted from state list as records could not be verified.)
- Maire, A. 1977. Identification des biotopes à larves de moustiques des tourbières de la Basse-Mauricie (Québec Méridional). Naturaliste Can. 104:429-440.
- . 1978. Colloque sur l'entomologie, les loisirs et al culture. La développement de l'urbanisme et des loisirs de plein air au Québec ets-il compatible avec celui des insectes piquers? Ann. Soc. Entomol. Quebec 23:108-115.
- . 1980. Ecologie comparée des espècies de moustiques holarctiques (Diptera: Culicidae). Can. J. Zool. 58:1582-1600.
- Maire, A. and A. Aubin. 1980. Les moustiques du Québec (Diptera: Culicidae). Essai de synthèse ecologique. Mem. Soc. Entomol. Quebec, No. 6, 107 pp.
- Maire, A., Y. Mailhot and A. Aubin. 1979. Caracterisation ecologique des biotopes a larves de moustiques (Culicidae) du littoral subarctique de la Baie de James, Québec. Can. Entomol. 111:251-272.

- Maire, A., Y. Mailhot, C. Tessier and R. Savignac. 1980. Records of *Aedes mercurator* from eastern James Bay, Quebec. Mosq. News 40:444-445.
- Maire, A., L. Picard and A. Aubin. 1979. Présence d'Aedes (Ochlerotatus) pullatus (Coquillett) (Diptera: Culicidae) dans les-Chic Chocs, Parc de la Gaspésie, Québec. Implications biogéographiques de cette extension d'aire. Can. J. Zool. 57:1576-1583. (New southernmost record for Ae. pullatus from eastern North America.)
- Maire, A., C. Tessier and L. Picard. 1978. Analyse écologique des populations larvaires de moustiques (Diptera: Culicidae) des zones riveraines du fleuve (Saint-Laurent), Québec. Naturaliste Can. 105:225-241.
- Maloney, F. A. 1980. New record for *Uranotaenia sapphirina* in Colorado. Mosq. News 40:451.
- Means, R. G. 1979. Mosquitoes of New York. Part I. The genus *Aedes* Meigen with identification keys to genera of Culicidae. Bull. No. 430a, New York State Mus., 221 pp. (Includes distribution maps.)
- Mogi, M. and J. Mokry. 1980. Distribution of Wyeomyia smithii (Diptera, Culicidae) eggs in pitcher plants in Newfoundland, Canada. Trop. Med. (Nagasaki) 22:1-12.
- Munstermann, L. W. 1980. Distinguishing geographic strains of the *Aedes atropalpus* group (Diptera: Culicidae) by analysis of enzyme variation. Ann. Entomol. Soc. Am. 73:699-704.
- Nayar, J. K. 1982. Bionomics and physiology of *Culex nigripalpus* (Diptera: Culicidae) of Florida: An important vector of diseases. Fla. Agric. Exp. Stn. Tech. Bull. 827:1-73.
- Newson, H. D. 1978. Culicidae, pp. 311-329. <u>In</u> R. W. Merritt and K. W. Cummins, eds. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Co., Dubuque, IA. (Keys to adults, larvae and pupae.)
- Nielsen, L. T. 1982. Aedes euedes H. D. & K. A report of a new record from Wyoming with notes on the species. Mosq. Syst. 14:133-134.
- Nielsen, L. T. and J. E. Mokry. 1982a. *Culiseta melanura* in Newfoundland. Mosq. News 42:274-275.
- _____. 1982b. The mosquitoes of the island of Newfoundland A report of new records and notes on the species. Mosq. Syst. 14:34-40. (New records for six *Aedes* species.)
- Pinkovsky, D. D. and R. J. McKenna. 1980. Distribution of mosquitoes in the continental United States. Final report for period 1943-1979. Report SAM-TR-80-45. USAF School of Aerospace Medicine, Brooks AFB, TX, 54 pp.

- Restifo, R. A. and G. C. Lanzaro. 1980. The occurrence of *Aedes atropalpus* (Coquillett) breeding in tires in Ohio and Indiana. Mosq. News 40:292-294. (New Indiana state record.)
- Ritchie, S. A. and W. A. Rowley. 1980. A new distributional record for *Psorophora cyanescens* in Iowa. Mosq. News 40:118. (New state record.)
- Roberts, D. R. and J. E. Scanlon. 1979. An evaluation of morphological characters for separating females of *Aedes (Ochlerotatus) atlanticus* Dyar and Knab and *Aedes (Ochlerotatus) tormentor* Dyar and Knab (Diptera: Culicidae). Mosq. Syst. 11:203-208.
- Savignac, R. and A. Maire. 1981. A simple character for recognizing second and third instar larvae of five Canadian mosquito genera (Diptera: Culicidae). Can. Entomol. 113:13-20.
- Shroyer, D. A., R. F. Beach, L. Munstermann, J. Peloquin, J. L. Peterson, R. P. Smith and D. B. Taylor. 1976 (1977). Mosquito diversity in St. Joseph County, Indiana (Diptera: Culicidae). Proc. Ind. Acad. Sci. 86: 238-241.
- Sirivanakarn, S. and J. N. Belkin. 1980. The identity of *Culex (Melanoconion)* taeniopus Dyar and Knab and related species with notes on the synonomy and description of a new species (Diptera: Culicidae). Mosq. Syst. 12:7-24.
- Steffan, W. A. 1980 (1981). The type-specimens of *Toxorhynchites* (Diptera: Culicidae) at the National Museum of Natural History. Mosq. Syst. 12: 379-385.
- Steffan, W. A. and N. L. Evenhuis. 1980. Description of the pupa of Toxorhynchites (Lynchiella) septentrionalis (Diptera: Culicidae). Mosq. Syst. 12:175-178.
- Stone, A. 1981. Culicidae, pp. 341-350. <u>In</u> J. F. McAlpine et al., Manual of nearctic Diptera. Vol. 1. Research Branch, Agriculture Canada, Ottawa. Monograph 27, 674 pp. (Contains family characterization; generic keys to adults and larvae.)
- Tessier, C., A. Maire and A. Aubin. 1981. Productivité en larves de moustiques (Diptera: Culicidae) des milieux aquatiques peu profonds d'un secteur du Moyen-Nord Québécois (LG-1, Territoire de la Baie de James). Can. J. Zool. 59:738-749.
- Trimble, R. M. and W. G. Wellington. 1979. Colonization of North American *Aedes togoi*. Mosq. News 39:18-20.
- White, D. J. and C. P. White. 1980. *Aedes atropalpus* breeding in artificial containers in Suffolk county, New York. Mosq. News 40:106-107. (New county records.)

- . 1981. The occurrence and relevance of arthropods of medical and veterinary importance captured during a survey on Plum Island, New York. J. N. Y. Entomol. Soc. 89:2-15.
- Zavortink, T. J. and J. N. Belkin. 1979. Occurrence of *Aedes hendersoni* in Florida (Diptera, Culicidae). Mosq. News 39:673. (New state record.)
- Zimmerman, R. H. and E. C. Turner, Jr. 1982. Mosquito distribution and abundance in an inland salt marsh, Saltville, Virginia. Mosq. News 42: 105-109. (New inland record for Ae. sollicitans.)